

**Region 39, 700 MHz Regional Planning Committee
John Johnson, Chairman
3041 Sidco Drive
Nashville, TN 37204**

May 12, 2005

Federal Communications Commission
Wireless Telecommunications Bureau
Chief, Public Safety and Private Wireless Division
445 12th Street, SW
Washington, DC 20554

Subject: WTB Docket No. 00-32, Region 39 – 4.9 GHz Regional Plan

Dear Sirs:

Attached is the Region 39 4.9 GHz Regional Plan for your review. This document is the result of over 18 months of work by the Region 39 Regional Planning Committee and the 4.9 GHz working group. We hope that this will serve as a guideline to the Region since a mandatory plan is not required.

I would like to commend the regional planning committee members for the hard work and long hours invested to address issues that will benefit public safety communications in the region. A special thanks to Jesse D. Griggs, with the Tennessee Department of Correction for heading up the 4.9 GHz Working Group.

I also want to thank the National Public Safety Telecommunications Council (NPSTC) and the NPSTC Support Office for their continued support to the region. The NPSTC support office was always available for questions regarding regional planning. The CAPRAD database training the Region 39 members received, the Colloquiums and Focus Groups will inevitably improve public safety spectrum planning and implementation within Tennessee.

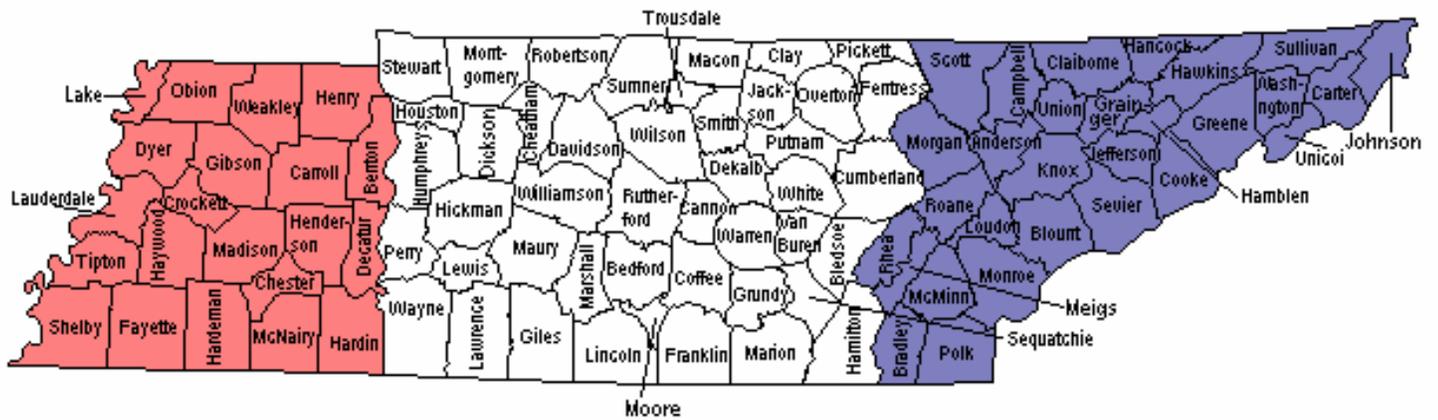
If you have any questions, please do not hesitate to contact me at (615) 741 – 3826.

Respectfully,
John W. Johnson
TN Emergency Management Agency
Chairman Region 39

Region 39

4.9 GHz Plan & Guidelines

4.940 GHz to 4.990 GHz Spectrum Guidance and Usage in Tennessee



(map from www.state.tn.us)

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1. Introduction

On May 2, 2003, the Federal Communications Commission released a Memorandum Opinion and Order and Third Report and Order (FCC 03-99) on FCC Docket 00-32, which allocates spectrum from 4.940-4.990 GHz to the public safety community and outlines operational and technical parameters for its usage. This guide is to be used as a tool to assist Regional Planning Committees (RPC) in the ongoing implementation of the band and offers suggestions and recommendations for usage. The 4.9 GHz Planning Committee was to function under the 700 MHz Regional Planning Committee.

The 700 MHz regional planning committees, per Commission's rule, have no *authority* in the development of the 4.940-4.990 GHz public safety allocations within their region. This means that users are not required to obtain regional concurrence when utilizing 4.940-4.990 GHz. However, Regional Planning Committees can guide and assist agencies within their region with education of the available spectrum, possible usage of the spectrum and implementation of the spectrum, within their community as well as in adjacent communities. The 700 MHz regional planning committee can also act as a *region wide clearinghouse* for documenting 4.9 GHz use in the region while contributing to the development and maturity of the band within their region as a *community resource*, available to all eligible entities.

The Region 39 700 MHz RPC established a 4.9 GHz working group to focus on creating this document to serve as a regional guide for the spectrum. Jesse Griggs with the Tennessee Department of Correction volunteered to serve as chair of this working group. This document is a compilation of NPSTC and FCC documents that should help an entity plan to deploy 4.9 GHz devices.

Just as the demographics and population vary within Region 39, so will the applications for using the 4.9 GHz broadband spectrum. The applications and operational considerations addressed in these guidelines are to be reviewed to allow a Tennessee community to utilize the spectrum as they deem necessary (within FCC Rules and Regulation) in meeting the needs of the public safety community in and around their jurisdiction. Users are strongly urged to review the FCC rules regarding the 4.9 GHz band (*Subpart Y - Regulations Governing Licensing and Use of Frequencies in the 4940–4990 MHz Band*, Part 90 Section 1201 – 90.1201 and forward) as well as the many filed comments contained in the history of Docket 00-32, including orders issued by the FCC on the public safety allocation of 4.940-4.990 GHz under the docket to provide Tennessee agencies with as much information as possible when implementing the band.

There are important issues regarding 4.9 GHz deployments that need to be acknowledged by the applicant to ensure effective and efficient operation of the band. The Region 39 700 MHz RPC looks forward to supporting the deployment of broadband public safety applications within Region 39 in a role supported and defined by the region.

2. Region Description

Region 39 encompasses the entire state of Tennessee, consisting of 95 counties. An alphabetized list of counties can be found listed in Appendix C.

Tennessee has been called the “Three States of Tennessee” because of its three grand divisions and the unique geography of each. The three grand divisions are East, Middle and West. Geographically, Tennessee is divided into six major natural regions. These areas, from east to west, are:

- 1) The Appalachian Mountain region along the North Carolina boarder with Mountain peaks ranging from 3000 to 6000 feet,
- 2) The Great Valley, also called the Grand Canyon of the East, with several long, narrow, even crested ridges running southwest to northeast and elevations of 1200 to 2500 feet,
- 3) The Cumberland Plateau again running from the southwest to the northeast it varies in width from 50 to 70 miles. It covers a total of about 4,260 square miles on a surface that is flat to rolling tableland that rises 800 to 1000 feet above the land on either side.
- 4) The Highland Rim with about 12,650 square miles outlines most of what is known as "Middle Tennessee." In the center of the Highland Rim is the Central Basin. Although the Highland Rim has a peak of over 2000 feet it has an average altitude of slightly less than 1000 feet. The terrain is "rough plateau" with the roughest parts along the edges of the Central Basin.
- 5) Central Basin is an oval depression that has a gently rolling surface with many small rounded hills that rise 200 to 300 feet above the general level. Terrain varies from about 500 to 1100 feet above sea level.
- 6) The Gulf Coastal Plain of West Tennessee covers all of what is known as West Tennessee with the area from Kentucky Lake and the Tennessee River to the Mississippi River. Generally it is a broad plain whose surface slopes to the west until it ends abruptly at the bluffs over looking the flood plain of the Mississippi River. Along the eastern edge streams have cut valleys that form a rough topography.

There are ninety five counties in the state with a total land mass of 41,219 square miles according to the 1996 Land Area Statistics, US Bureau of the Census. The largest county is Shelby, with a total of 755 square miles. Water features of significance, are the Mississippi, Tennessee and Cumberland Rivers, Reelfoot Lake (natural), Watauga, Norris, Watts Bar, Chickamauga, Dale Hollow, Center Hill, Percy Priest, Old Hickory, Tims Ford, Pickwick, Kentucky and Barkley Lakes (manmade). Tennessee has 477 square miles of water within it's' boundaries.

As shown above, the population of over five million people is distributed across nearly forty two thousand square miles of widely varying terrain. This presents some unique problems in area coverage for radio systems since the entire land area of any given jurisdiction must be covered. The population per square miles in urban areas tends to be dense and in rural areas tends to be sparse. The population distribution and the very diverse geographical features of the state must be carefully considered in communications system planning. All these items were taken under consideration in the allocation plan.

Tennessee's population according to the 2002 Census of Population and Housing, U. S. Bureau of Census, as found in the *Tennessee Blue Book*, is 5,797,289. Tennessee has four metropolitan areas plus the Tri-Cities area spread across the State. These five areas make up 64% of the population. Three of these metropolitan areas border other states. Memphis is the largest metropolitan area and borders Mississippi and Arkansas. Nashville, the capitol city, is the second largest and has a metropolitan area that extends to the Kentucky state line. This is the fastest growing area in Tennessee and one of the fastest in the nation, with the adjacent cities of Murfreesboro, Franklin, Lebanon and near by Clarksville. Clarksville is home to Ft. Campbell and the 101st Airborne (though it is actually in Kentucky) but greatly impacts Tennessee. Knoxville is the third largest and includes the city of Oak Ridge. The fourth area is Chattanooga which borders Georgia and Alabama. The fifth largest metropolitan area is the Tri-Cities area made up of Bristol, Johnson City and Kingsport. Bristol is split into two towns by the Virginia / Tennessee border. Also a factor in the Tri-Cities metropolitan area is the proximity of Virginia, North Carolina and Kentucky.

Tennessee also has six and soon to be seven interstate systems. I – 40 runs across Tennessee from North Carolina to Arkansas, I – 65 runs from Kentucky to Alabama, I – 24 run from Kentucky to Georgia, I – 75 runs from Georgia to Kentucky, I – 81 from I – 40 near Knoxville to Virginia, I – 26 from I-81 near Johnson City into North Carolina and I – 155 from I -55 in Missouri to US Hwy 51 in Dyersburg. Soon I 69 will run from Kentucky to Mississippi through west Tennessee and may connect into I – 155.



(Map from www.state.tn.us)

REGION 39 COUNTY DATA

As of May, 2005

County Name	County Seat	Square Miles ¹	Population 1990 ²	Population 2000 ²	Population 2002 ²
Anderson	Clinton	338	68,250	71,330	71,627
Bedford	Shelbyville	474	30,411	37,586	39,408
Benton	Camden	394	14,524	16,537	16,483
Bledsoe	Pikeville	406	9,669	12,367	12,478
Blount	Maryville	559	85,969	105,823	109,849
Bradley	Cleveland	329	73,712	87,965	89,677
Campbell	Jacksboro	480	35,079	39,854	40,013
Cannon	Woodbury	266	10,467	12,826	13,060
Carroll	Huntingdon	599	27,514	29,475	29,320
Carter	Elizabethton	341	51,505	56,742	56,746
Cheatham	Ashland City	303	27,140	35,912	36,986
Chester	Henderson	289	12,819	15,540	15,923
Claiborne	Tazewell	434	26,137	29,862	30,163
Clay	Celina	236	7,238	7,976	8,021
Cocke	Newport	434	29,141	33,565	34,115
Coffee	Manchester	429	40,339	48,014	49,408
Crockett	Alamo	265	13,378	14,532	14,522
Cumberland	Crossville	682	34,736	46,802	48,604
Davidson	Nashville	502	510,784	569,891	570,785
Decatur	Decaturville	333	10,472	11,731	11,629
DeKalb	Smithville	304	14,360	17,423	17,700
Dickson	Charlotte	490	35,061	43,156	44,231
Dyer	Dyersburg	510	34,854	37,279	36,984
Fayette	Somerville	705	25,559	28,806	31,202
Fentress	Jamestown	499	14,669	16,625	16,868
Franklin	Winchester	553	34,725	39,270	39,998
Gibson	Trenton	603	46,315	48,152	48,274
Giles	Pulaski	611	25,741	29,447	29,355
Grainger	Rutledge	280	17,095	20,659	21,109
Greene	Greeneville	622	55,853	62,909	63,763
Grundy	Altamont	361	13,362	14,332	14,335
Hamblen	Morristown	161	50,480	58,128	58,623
Hamilton	Chattanooga	543	285,536	307,896	309,321
Hancock	Sneedville	222	6,739	6,786	6,793
Hardeman	Bolivar	668	23,377	28,105	29,812
Hardin	Savannah	578	22,633	25,578	25,825

Hawkins	Rogersville	487	44,565	53,563	54,793
Haywood	Brownsville	533	19,437	19,797	19,655
Henderson	Lexington	520	21,844	25,522	25,733
Henry	Paris	562	27,888	31,115	31,192
Hickman	Centerville	613	16,754	22,295	23,125
Houston	Erin	200	7,018	8,088	7,948
Humphreys	Waverly	532	15,795	17,929	18,081
Jackson	Gainesboro	309	9,297	10,984	11,138
Jefferson	Dandridge	274	33,016	44,294	45,801
Johnson	Mountain City	299	13,766	17,499	17,925
Knox	Knoxville	509	335,749	382,032	389,327
Lake	Tiptonville	163	7,129	7,954	7,793
Lauderdale	Ripley	471	23,491	27,101	28,007
Lawrence	Lawrenceburg	617	35,303	39,926	40,463
Lewis	Hohenwald	282	9,247	11,367	11,463
Lincoln	Fayetteville	570	28,157	31,340	31,777
Loudon	Loudon	229	31,255	39,086	40,631
Macon	Lafayette	307	15,906	20,386	20,860
Madison	Jackson	557	77,982	91,837	93,367
Marion	Jasper	500	24,860	27,776	27,654
Marshall	Lewisburg	375	21,539	26,767	27,370
Maury	Columbia	613	54,812	69,498	71,600
McMinn	Athens	430	42,383	49,015	50,051
McNairy	Selmer	560	22,422	24,653	24,716
Meigs	Decatur	195	8,033	11,086	11,310
Monroe	Madisonville	635	30,541	38,961	40,159
Montgomery	Clarksville	539	100,498	134,768	138,241
Moore	Lynchburg	129	4,721	5,740	5,928
Morgan	Wartburg	522	17,300	19,757	19,847
Obion	Union City	545	31,717	32,450	32,394
Overton	Livingston	433	17,636	20,118	20,276
Perry	Linden	415	6,612	7,631	7,548
Pickett	Byrdstown	163	4,548	4,945	4,999
Polk	Benton	435	13,643	16,050	16,142
Putnam	Cookeville	401	51,373	62,315	64,300
Rhea	Dayton	316	24,344	28,400	28,939
Roane	Kingston	361	47,227	51,910	52,316
Robertson	Springfield	477	41,494	54,433	57,446
Rutherford	Murfreesboro	619	118,570	182,023	194,934
Scott	Huntsville	532	18,358	21,127	21,558
Sequatchie	Dunlap	266	8,863	11,370	11,787
Sevier	Sevierville	592	51,043	71,170	74,456
Shelby	Memphis	755	826,330	897,472	905,678
Smith	Carthage	314	14,143	17,712	18,177
Stewart	Dover	458	9,479	12,370	12,704

Sullivan	Blountville	413	143,596	153,048	153,051
Sumner	Gallatin	529	103,281	130,449	136,170
Tipton	Covington	459	37,568	51,271	53,436
Trousdale	Hartsville	114	5,920	7,259	7,354
Unicoi	Erwin	186	16,549	17,667	17,740
Union	Maynardville	224	13,694	17,808	18,541
Van Buren	Spencer	274	4,846	5,508	5,541
Warren	McMinnville	433	32,992	38,276	38,896
Washington	Jonesborough	326	92,315	107,198	109,019
Wayne	Waynesboro	734	13,935	16,842	17,312
Weakley	Dresden	580	31,972	34,895	34,208
White	Sparta	377	20,090	23,102	23,434
Williamson	Franklin	582	81,021	126,638	136,889
Wilson	Lebanon	571	67,675	88,809	93,079
TOTAL		41,219	4,877,185	5,689,283	5,797,289

Footnotes:

1 - 1996 Land Area Statistics, U.S. Bureau of the Census.

2 - 1990, 2000, and 2002 Census of Population and Housing, U.S. Bureau of the Census

Taken from www.state.tn.us/

Tennessee Blue Book, State of TN, Web Site

3. Regional Planning and Spectrum

Regional Planning Authority

Per FCC 03-99, Regional Planning Committees (RPC) can assist entities within the region in the administration and implementation of the 4.9 GHz public safety spectrum within their region. Per the Order, the RPC is required to have held a regional planning meeting for the expressed purpose of addressing the 4.9 GHz needs of the region. Region 39 held such a meeting on December 11, 2003 in Nashville, TN. A subsequent meeting was held on December 7, 2004.

3.1 Operation of the Regional Plan Working Group

The Region 39 4.9 GHz will operate as a standing committee (working group) under the 700 MHz Regional Planning Committee. This committee will rule by consensus. A quorum will be a majority of the members present. All decisions will be by a majority consensus vote with each Public Safety Agency having one vote. The meetings are open to all persons and a public input time is given for anyone to express a viewpoint or to have input to the planning process.

The 4.9 GHz committee meeting will coincide with the Region 39 700 MHz RPC meeting when needed or a special meeting may be called with sufficient notice as governed by the 700 MHz RPC By-Laws.

3.2 Spectrum Overview

The 4.9 GHz band is intended to accommodate a variety of new broadband applications such as high-speed digital technologies and wireless local area networks (LAN) for incident scene management, dispatch operations and vehicular operations. This includes mobile operations, fixed hotspot use (similar to what is common with Wi-Fi), and temporary fixed links, as well as fixed point-to-point operations on a "secondary" basis. In addition, technology planned for this frequency band also includes the ability for the automatic formation of "Ad-Hoc" wireless LANs composed of the wireless data network elements of diverse agency units as they arrive on scene at an incident.

The FCC established a "jurisdictional" geographical licensing approach for operations in this band, whereby licensees will be licensed for the full 50 MHz and will be authorized to operate in those geographic areas over which they have jurisdiction, but they will be required to cooperate with others in the shared use of the spectrum. This band is also intended to foster interoperability by providing a regulatory framework in which traditional public safety entities can pursue strategic partnerships with both traditional public safety entities, such as the Federal Government, and non-traditional public safety entities, such as utilities and commercial entities, in support of their missions regarding homeland security and protection of life and property.

The 50 MHz spectrum within this frequency band consists of ten each 1 MHz wide channels and eight each 5 MHz channels, which can be aggregated if necessary to form wider channels up to a 20

MHz bandwidth maximum where higher data rates are desired. Maximum transmit power allowed in this band is 2 watts when a maximum bandwidth channel is required. Use of this spectrum in some areas is restricted based upon existing military training use and on radio astronomy applications. Refer to the FCC web site link http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-03-99A1.doc for the FCC's Memorandum Opinion and Order and Third Report and Order of FCC Docket 00-32 detailing this 4.9 GHz public safety band.

3.3 User Eligibility

Eligibility requirements for deployment and operation of systems in the 4.9 GHz frequency band are as follows. Entities providing Public Safety services meeting the eligibility criteria found in Title 47 Codes of Federal Regulations (CFR) §90.1203 and §90.523, both titled "*Eligibility*" may deploy/operate a wireless public safety communication system incorporating this imminently available 4.9 GHz public safety spectrum subject to all the Federal Communications Commission rules/conditions associated with its usage.

3.4 FCC License Requirements

An FCC license is required to operate in this spectrum. There are two types of licenses in the 4.9 GHz band. First and "Primary" is the Geographic license that covers the full 50 MHz of spectrum. All eligible entities granted this FCC receives the same frequency spectrum. The State, County and City will receive the same spectrum to use. The entire 4.9 GHz band is shared spectrum. There is no requirement for frequency coordination in the 4.9 GHz band.

The other type of license is a site specific license. This type of license is for permanent fixed operation such as a microwave link. Title 47, Part 90.1207 addresses the Licensing requirement.

90.1207 Licensing

(a) A 4940-4990 MHz band license gives the licensee authority to operate on any authorized channel in this band within its licensed area of operation. See § 90.1213 of this subpart. A 4940-4990 MHz band license will be issued for the geographic area encompassing the legal jurisdiction of the licensee or, in case of a nongovernmental organization, the legal jurisdiction of the state or local governmental entity supporting the nongovernmental organization.

(b) Subject to § 90.1209 of this subpart, a 4940-4990 MHz band license gives the licensee authority to construct and operate any number of base stations anywhere within the area authorized by the license, except as follows:

(1) A station is required to be individually licensed if:

- (i) International agreements require coordination;
- (ii) Submission of an environmental assessment is required under § 1.1307 of this chapter; or
- (iii) The station would affect the radio quiet zones under § 1.924 of this chapter.

(2) Any antenna structure that requires notification to the Federal Aviation Administration (FAA) must be registered with the Commission prior to construction under § 17.4 of this Chapter.

(c) A 4940-4990 MHz band license gives the licensee authority to operate mobile units (including portable and handheld units) and operate temporary (1 year or less) fixed stations anywhere within the area authorized by the license. Such licensees may operate mobile units and/or

temporary fixed stations outside their authorized area to assist public safety operations with the permission of the jurisdiction in which the radio station is to be operated. Temporary fixed stations are subject to the requirements of paragraph (b) of this section.

(d) A 4940-4990 MHz band license does not give the licensee authority to operate permanent fixed point-to-point stations. Licensees choosing to operate such fixed stations must license them individually on a site-by-site basis. Such fixed operation will be authorized only on a secondary, noninterference basis to base, mobile and temporary fixed operations.

3.5 Procedure for Obtaining a FCC License

Any eligible public safety entity within Region 39 may apply for a FCC geographic license for the 4.9 GHz spectrum. A geographic license means that there is no specific fixed coordinates, latitude and longitude, associated with this license. The license is issued for an entities geographic area. For example, the State of Tennessee's license encompasses the entire state of Tennessee. A county entity's license would encompass the entire county.

Since neither frequency coordination nor coordination with the Regional Planning Committee is required, a license application is filed directly with the FCC using the FCC's Universal Licensing System. This is done on-line over the internet.

The service code of the 4.9 GHz geographic license is "PA". Region 39 suggests that when filing for the license, two Schedule D's be submitted. One Schedule D for temporary fixed usage "TF" and one for mobile operation "MO".

A Public Safety agency wanting to use the spectrum for a permanent fixed point to point application, such as a microwave link, will have to file a license that identifies the specific location and channels used. A site specific license will be "Secondary" to the "primary" geographic license. Contact the FCC for information on how to file this type of license.

3.6 Permissible Operations

This section is taken from FCC Part 90.1205

90.1205 Permissible operations.

- (a) Unattended and continuous operation is permitted.
- (b) Voice, data and video operations are permitted.
- (c) Aeronautical mobile operations are prohibited.

Further discussion on aeronautical operations can be found in Section 10 of this document.

4. Spectrum Application and Usage

Personal Area Networks (PAN) or (PLAN)

- Will enable Blue tooth type applications in a vehicle, thereby removing wiring that can restrict end users.
- Will change mobile unit design in public safety, as 4.9 GHz Spectrum will enable broadband environments for the user. PAN technologies can offer public safety agencies alternatives in the design of in vehicle unit hardware placement, as 4.9 GHz wireless capabilities can change broadband access environments for the end user.
- Peer to Peer Networking (ADHOC) Architecture works with Personnel Area Networks in developing self-healing, self-forming broadband networks. Particularly, this technology can bring broadband connectivity to subscribers operating within an isolated incident scene. Ad-Hoc networking using 4.9 GHz is technology currently available from multiple vendors, utilizing both proprietary and non-proprietary protocols.
- On a small scale, these communications devices can interact and provide connectivity with public safety users other devices.

Vehicular Local Area Networks (VLAN)

- An area around the vehicle where broadband access is brought out of the vehicle, think Blue-tooth, short range type applications.
- Within 50 ft of a vehicle, a LAN will be deployed to manage/monitor life critical functions, such as pulse, heartbeat, blood pressure, oxygen level in First Responders and connect the end user to his vehicle.

Hotspots

- The most commonly assumed public safety application. Nodes will be placed in strategic areas in a community, shared by multiple agencies/disciplines, which will enable seamless high capacity download of video and other large files. These base stations are covered under the jurisdictional area license issued to the agency.
- Many communities will develop single site areas and begin to connect them together to develop seamless wider area broadband environments where necessary. It is anticipated that broadband access will grow incrementally within an agency and, to a gradual rate, throughout a community.
- Hardware will be COTS based (Commercial Off The Shelf) capable of utilizing the 801.11A chipset that are widely available. This technology is tolerant to adjacent/co-channel interference as throughput reduction occurs as a result of adjacent channel interference, rather than the entire operation becoming ineffective. It is important to stress that *interference* in broadband data applications can result, in some cases, in a reduction in data throughput to the end user. The coordination of channel use within and around a community between agencies and users will contribute to the development of consistent broadband data capabilities for all users.

Fixed Point-Point

- Fixed point-point temporary at 4.9 GHz is primary in the band for up to one year. Command post/emergency response usage is assumed for periods of up to one year. Longer than that, must license site-site and it will become secondary to other applications.
- Permanent fixed point-point at 4.9 GHz has to be licensed site by site. The 4.9 GHz Band is not intended for dedicated point-point use. Permanent is deployed for over 1 year. Permanent fixed point-point is secondary to the previously mentioned primary uses of the band.
- Permanent fixed operations must be licensed separately as secondary users.
- It is anticipated that permanent point to point users in various areas of Region 39 will utilize one or two 1 MHz 4.9 GHz bandwidths “links” to distribute voice between remote receive sites and dispatch centers. These permanent “links”, while secondary per the FCC’s rules, might be an appropriate use of the band in areas where established primary applications might not be appropriate or available. Remote “links” between receivers and dispatch centers might

be a more cost effective alternative to supplant existing dedicated circuits used for that purpose. Agencies utilizing this type of application are encouraged to keep antenna heights above 100' when possible to minimize interference to ground units utilizing the same spectrum.

4.1 Conceptual planning considerations:

Public Safety Communications Devices

Public safety personnel in these scenarios communicate using a device that is portable (hand held portable or wearable), unless specifically noted for Command Post or other in-vehicle use. Throughout this document, these devices will be referred to as Public Safety Communications Devices (PSCD).

Public Safety Communications Users Group

Public safety personnel and resources that are recognized by the system to share communications and information. This implies that traffic related to this user only traverses the portion of the network necessary to reach all members of a particular user group. Each user group can be permanent unit or a temporary unit created by an authorized user for a particular purpose.

System of Systems

The communications devices are associated with systems or networks that range in size from small to large. Whether large or small, the systems work with each other to pass information and communications back and forth seamlessly, forming a system of systems.

Personal Area Network (PAN)

On the small scale, the communications device interacts with other devices that belong with the public safety individual. A first responder is equipped with wireless devices used to monitor the first responder's physical location, pulse rate, breathing rate, oxygen tank status, as well as devices for hazardous gas detection and voice communications. The devices are all linked wirelessly on a personal area network (PAN) controlled by the first responder's communication device.

5. RPC Administrative Support for Providing Regional Assistance

- The Region 39 700 MHz Regional Planning Committee (RPC) will support the implementation of 4.9 GHz throughout Tennessee through education and outreach. The Regional Planning Committee looks forward to acting as a "clearinghouse" for the use of 4.9 GHz, acting as an advocate for the development of the band throughout Tennessee's communities. The RPC hopes to utilize the CAPRAD database to document 4.9 GHz use in Tennessee. Details such as which licensees are participating in 4.9 GHz development in a community, what channels are utilized, locations of where shared access points are located, where fixed applications are used and the monitoring of the progress of the evolving broadband community will be kept in the CAPRAD database.

- The RPC will also provide information on areas of Region 39 where multiple jurisdictions overlap and provide contact information for other licensees in an area when inquiries from the area are received.

6. Interference Protection

Neither the FCC nor the Regional Planning Committee guarantees interference protection in the 4.9 GHz spectrum. Systems should be engineered to facilitate resource sharing where feasible.

Licensee should work with other local, county and state agencies prior to deployment of systems to mitigate interference.

In FCC 03-99, section 28, the FCC states the following:

“We also note that all 4.9 GHz band licensees and users will be bound by Section 90.173(b) of our rules, which requires applicants and licensees to cooperate in the selection and use of frequencies so as to reduce interference and maximize effective use of authorized facilities.⁸⁸

Licensees of stations suffering or causing harmful interference are expected to cooperate and resolve this problem by mutually satisfactory arrangements.⁸⁹”

7. Channel Allocation of Spectrum

The FCC permits aggregated channel bandwidths of 5, 10, 15, or 20 MHz.

Channel numbers 1-5 (yellow) and 14-18 (blue) are 1 MHz channels.

Channel numbers 6-13 (green) are 5 MHz channels.

Center Frequency (MHz)	Channel #	Bandwidth
4940.5	1	1 MHz
4941.5	2	1 MHz
4942.5	3	1 MHz
4943.5	4	1 MHz
4944.5	5	1 MHz
4947.5	6	5 MHz
4952.5	7	5 MHz
4957.5	8	5 MHz
4962.5	9	5 MHz
4967.5	10	5 MHz
4972.5	11	5 MHz
4977.5	12	5 MHz

4982.5	13	5 MHz
4985.5	14	1 MHz
4986.5	15	1 MHz
4987.5	16	1 MHz
4988.5	17	1 MHz
4989.5	18	1 MHz

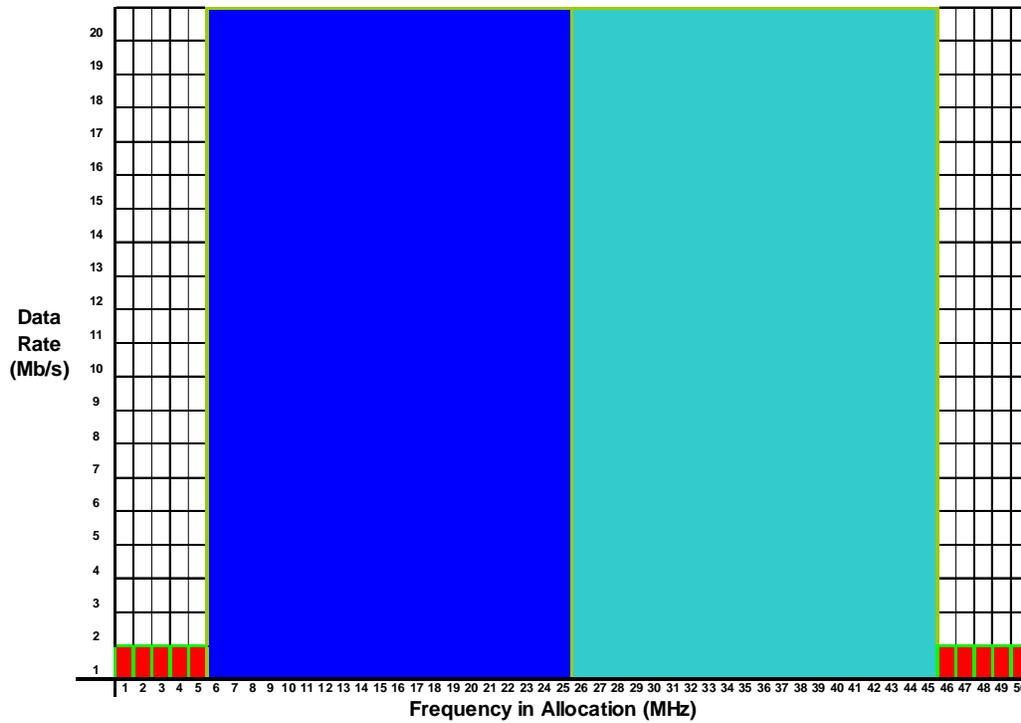
Table 7.1: Channel Allocation Table
 Courtesy of Federal Communications Commission
 Docket 00-32 Page A-7

7.1 Possible Region 39, 4.9 GHz Channel Designation Example

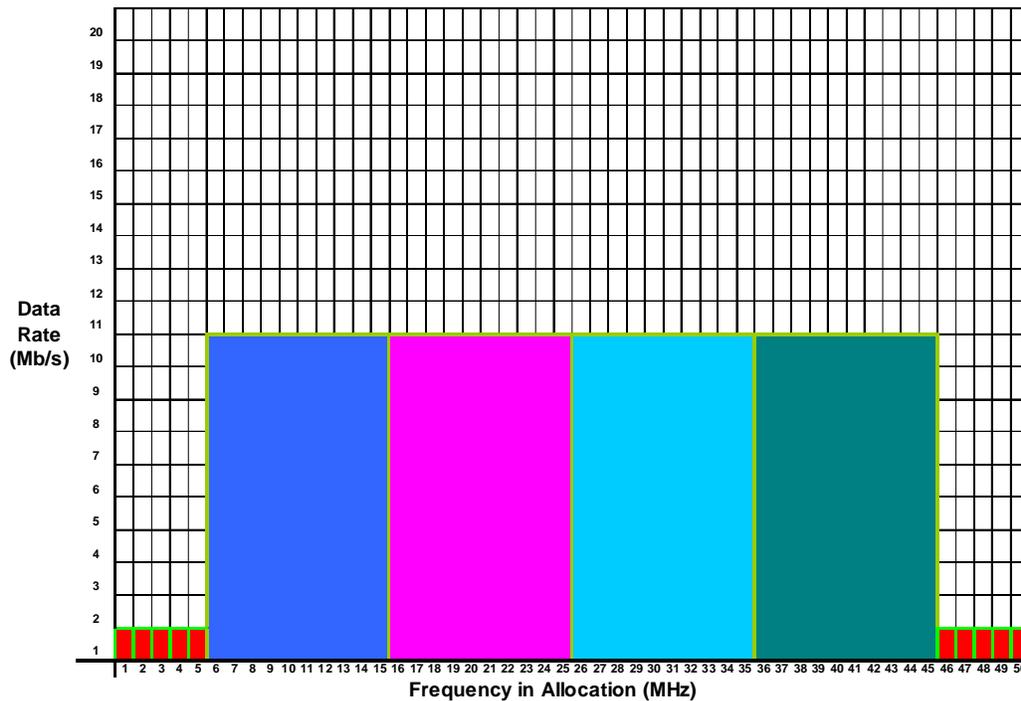
Courtesy of NPSTC National Regional Plan Guideline

Below are channel configurations available within the 4.9 GHz band. Any combination or variance of these channels may be required to meet a community's broadband defined need. Agencies desiring to develop broadband capabilities in their jurisdiction using 4.9 GHz, or any other spectrum dedicated to broadband technologies, are encouraged to share their broadband needs and intentions with neighboring agencies, which may also be developing similar plans. Note the data rates associated with each channel bandwidth.

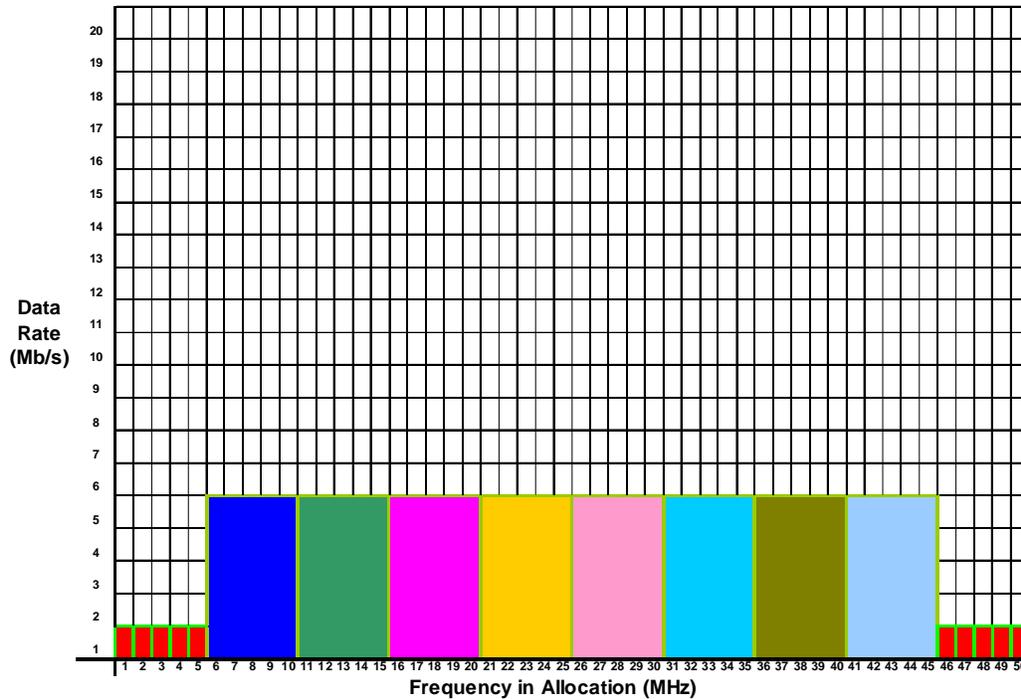
4.940-4.990 GHz potential channel designations



Two (2) Twenty (20) MHz channels, utilizing 40 MHz of the available 50 MHz at from 4.940-4.990 GHz, accompanied by two sets of 5 one (1) MHz channels above and below the allotment. Each set of five one (1) channels can be aggregated to a maximum of 5 MHz. 20 MHz channels at 5 GHz are typical of channels utilized in IEEE 802.11A standards operating with unlicensed 5 GHz spectrum.



Four (4) Ten (10) MHz channels, utilizing 40 MHz of the available 50 MHz at from 4.940-4.990 GHz, accompanied by two sets of 5 one (1) MHz channels above and below the allotment. Each set of five one (1) channels can be aggregated to a maximum of 5 MHz. 10 MHz channels at 5 GHz are sized consistent with broadband radio spectrum utilized currently in Japan and the channel size currently projected in the developing IEEE 802.11J standard, designed to improved mobility within the 802.11 standard.



Eight (8) Five (5) MHz channels, utilizing 40 MHz of the available 50 MHz at from 4.940-4.990 GHz, accompanied by two sets of 5 one (1) MHz channels above and below the allotment. Each set of five one (1) channels can be aggregated to a maximum of 5 MHz. While no IEEE 802.11 standards are in development currently for channels sized at 5 MHz of bandwidth, applications in IEEE 802.16 and IEEE 802.20, the use of 5 MHz channel bandwidths are expected to be developed and utilized in public safety 4.9 GHz applications.

7.2 4.9 GHz Channel Designation Example

4.940 – 4.945	4.945 – 4.955	4.955 – 4.965	4.965 – 4.975	4.975 – 4.987	4.985 – 4.990
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5 MHz Block For multiple or aggregate 1 MHz applications Air Video Link PAN/VLAN Point to Point microwave Links	10 MHz Block Might be useful in secondary or primary fixed operations in region or hotspots	10 MHz Network Block For node type application or hotspot	10 MHz Network Block For node type application or hotspot	10 MHz Network Block For node type application or hotspot	5 MHz Block For multiple or aggregate 1 MHz applications PAN/VLAN Point to Point microwave Links
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8.0 Technical Reference

8.1 High Peak Power Limitations

Channel Size	Power dBm	Power in Watts
1 MHz Channel	- 20	100 milli Watts
5 MHz Channel	- 27	500 milli Watts
10 MHz Channel	- 30	1 Watt
15 MHz Channel	- 31.8	1.5 Watts
20 MHz Channel	- 33	2 Watts

High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to a peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the peak transmit power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point or point-to-multipoint operation (both fixed and temporary fixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the transmitter power or spectral density. Corresponding reduction in the peak transmit power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi.

8.2 Low Peak Power Limitations

Channel Size	Power dBm
1 MHz Channel	- 7
5 MHz Channel	- 14
10 MHz Channel	- 17
15 MHz Channel	- 18.8

Low power devices are also limited to a peak power spectral density of 8 dBm per one MHz. Low power devices using channel bandwidths other than those listed above are permitted; however, they are limited to a peak power spectral density of 8 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the peak transmit power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi.

8.2 Emission Mask

The following is taken from FCC 04-365, Memorandum Opinion and Order, Section 10.

“Decision. We recognize that benefits would accrue to public safety agencies if they could use 4.9 GHz devices adapted from COTS technologies in nearby bands. In particular, leveraging such technologies could result in savings for state and local governments and provide the potential for deployment of dual-band devices that make Internet access available via the U-NII band adjacent to the 4.9 GHz band. We are persuaded by the comments submitted that we may safely adopt the DSRC-A and DSRC-C masks³⁶ in lieu of the Section 90.210 Mask currently in our Rules, and, therefore, will not burden public safety agencies with unnecessary costs for 4.9 GHz devices.”

9. Quiet Zone and Radio Astronomy Protection

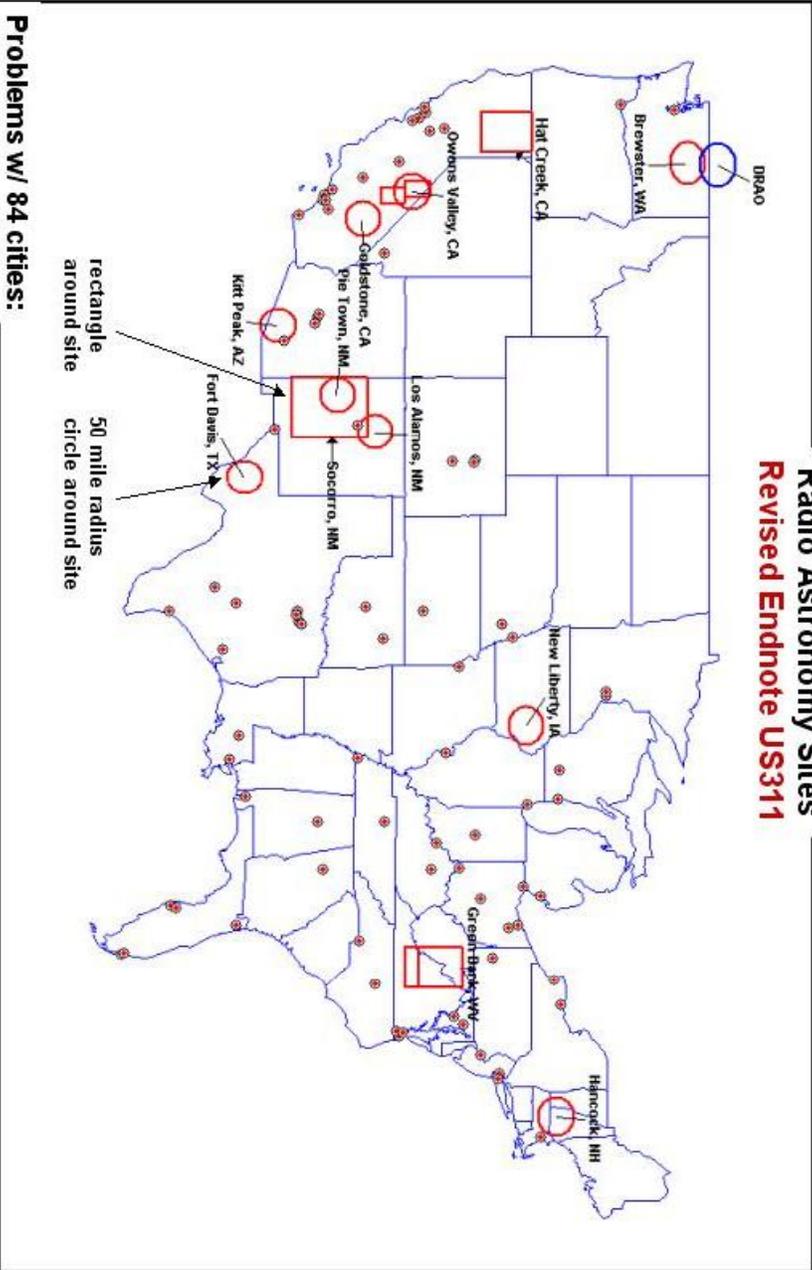
The 4.9 GHz is adjacent to the radio astronomy service both internationally and in the United States. Region 39 is not affected by any Quiet Zones. Consideration should be given to entities in Upper East TN since the 50 mile protection area comes very close to Region 39. Attached are two maps showing both Quiet Zones and Radio Astronomy Observatories.

The FCC concluded in FCC 03-99, Memorandum Opinion and Order and Third Report and Order, Section 46 the following:

“Accordingly, we decline to place any restrictions on public safety operations to protect those radio astronomy sites contained in footnote US74. We will, however, require 4.9 GHz band licensees to protect radio astronomy observatories to the extent required in footnote US74. Furthermore, as discussed above, we will continue to prohibit aeronautical mobile operations absent a clear showing that such operations will not interfere with radio astronomy operations.”

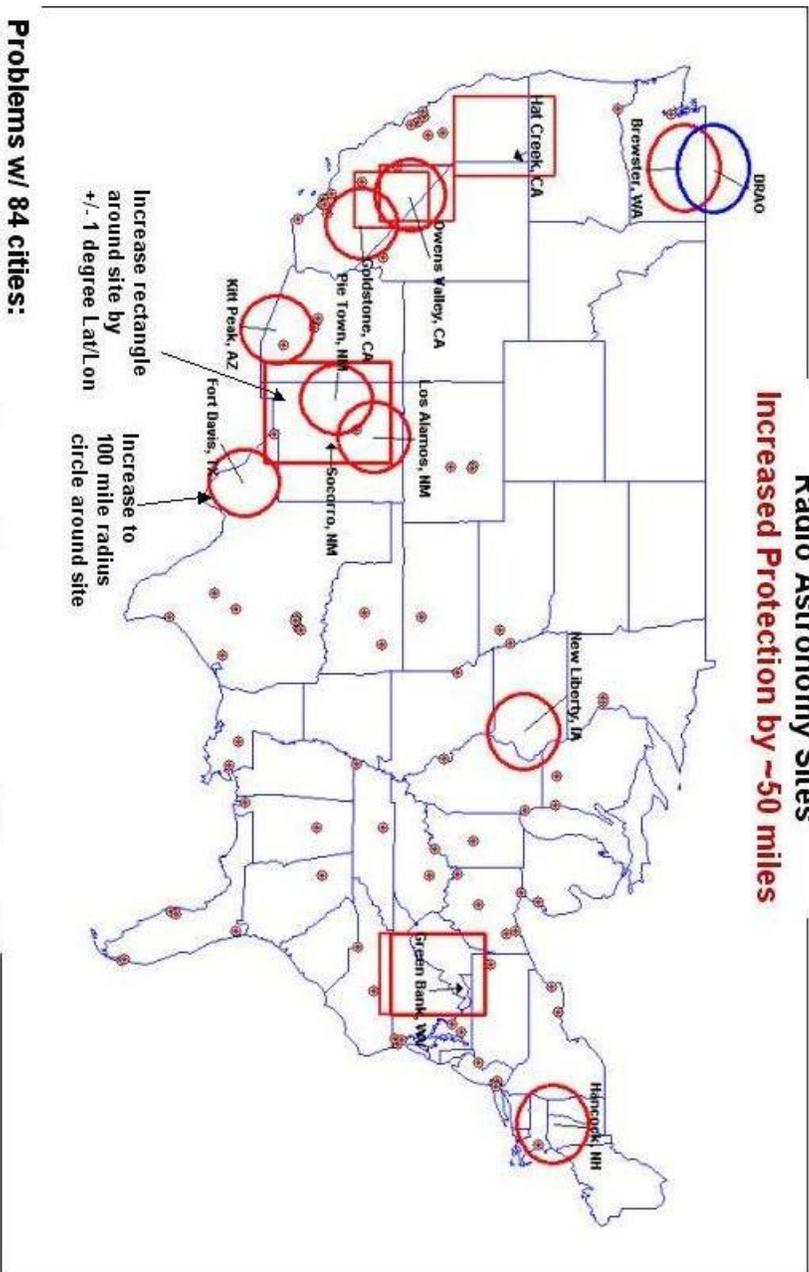
Aircraft operation is addressed in the Section 10 of this document.

4940-4990 GHz
Radio Astronomy Sites
Revised Endnote US311



Problems w/ 84 cities:
Albuquerque, NM
Tucson, AZ

4940-4990 GHz
Radio Astronomy Sites
Increased Protection by ~50 miles



Problems w/ 84 cities:
Albuquerque, NM
Tucson, AZ

Fresno, CA
Bakersfield, CA

El Paso, TX
Boston, MA

10. Usage of 4.9 GHz in Aircraft

The grant of an FCC geographic license in the 4.9 GHz spectrum does not authorize usage in aircraft. (See 10.1) If a public safety agency desires to use 4.9 GHz in an aircraft, it will be allowed on a case by case basis by the FCC due to the proximity of the 4.9 GHz spectrum to the Radio Astronomy band. In Region 39, there are two Radio Astronomy sites, one in Memphis and one in Nashville. Before any entity in Region 39 implements 4.9 GHz in aircraft, they must file a waiver request with the FCC. See 10.2 below.

Below are two excerpts from the FCC:

10.1 From FCC 03-99, Memorandum Opinion & Order, Third Report and Order, Executive Summary Section 4:

We deny petitions for reconsideration of the Commission's decision to prohibit aeronautical mobile operations in the 4.9 GHz band. We continue to believe that there is insufficient information demonstrating, as a general matter, that aeronautical mobile operations could be accommodated without adversely affecting radio astronomy operations. We nonetheless recognize the public safety community's interest in utilizing the 4.9 GHz band for aeronautical mobile operations and provide a mechanism whereby such operations could be allowed on a case-by-case basis provided that there is a sufficient technical showing made that the proposed operations would not interfere with in-band and adjacent band radio astronomy operations.

10.2 FCC 03-99, Memorandum And Order And Third Report And Order Section 13:

Thus, an entity seeking to use the band for airborne operations must file a waiver request attached to an application to modify its license authorizing it to use the 4.9 GHz band generally²⁸ to also authorize airborne operations. The waiver request should provide all the technical parameters of the proposed operation and should include a technical showing, using established criteria, demonstrating that the proposed operations will not cause interference to any radio astronomy operations. Any such request must also demonstrate how the intended airborne operations will protect other 4.9 GHz band operations. We plan to coordinate any requests for airborne operations with the National Telecommunication and Information Administration (NTIA) prior to taking action on such requests.

Appendix A Committee Members

LAST	FIRST	AGENCY/REPRESENTING	ADDRESS		CITY	ST	ZIP	
Adgent	Tim	TEMA	3041 Sidco Dr		Nashville	TN	37204	
Beasley	Roland	Memphis Light Gas and Water	2425 Covington Pike		Memphis	TN	38128	
Brooks	Lee	Spring Hill P.D.	P.O. Box 789		Spring Hill	TN	37174	9
Bull	Alan	Knox County 911	605 Bernard Ave.		Knoxville	TN	37927	
Cansler	Stephen	Davis Electronics	617 Hwy 52 Bypass E		Lafayette	TN	37083	
Carroll	Mike	TN Dept of Transportation	6600 Centennial Blvd		Nashville	TN		
Chafin	Keith	CommTech	441 Donelson Pike	Suite 420	Nashville	TN	37214	
Coffelt	Roger	TN Dept. of Corrections	6th Ave. North		Nashville	TN	37243	
Coman	Ben	MTSU Public Safety	1412 E. Main St		Murfreesboro	TN	37132	
Dabbs	John	TN Dept of Health EMS Division	1233 Southwest Ave Ext		Johnson City	TN	37604	
Davis	Ivon	Davis Electronics	617 Hwy 52 Bypass E		Lafayette	TN	37083	
Ditmore	Ann Rita	Central Comm & Electronics	PO Box 3638		Knoxville	TN	37927	
Evans	Mike	Motorola	2060 15th Ave S.		Nashville	TN	37212	
Farro	Wayne	M/A-COM	128 Holiday Ct	Suite 112	Franklin	TN	37067	
Fanguy	Jim	MTSU Public Safety	1412 E. Main St		Murfreesboro	TN	37132	
Furlow	Albert	Safety			Nashville	TN		
Gowler	Randy	TN Dept of Health	Cordell Hull Bldg		Nashville	TN	37247	
Griggs	Jesse	TN Dept of Corrections	6000 State Rd		Memphis	TN	38139	
Hatch	Kip	City of Jackson	105 E. Main	Suite 103	Jackson	TN	38305	
Hooper	Arnold	City of Chattanooga	3300 1/2 Amnicola Hwy.		Chattanooga	TN	37406	
Hopson	Mike	Fayetteville Lincoln Co Emerg. Comms.	607 Moyers Ave		Fayetteville	TN	37334	

Insalaco	Frank V.	45th Civil Supply Team	551 VTS		Smyrna	TN	37167
Johnson	John	TEMA / Region 39	3041 Sidco Dr		Nashville	TN	37204
Land	Richard	TN Dept of Health EMS Division	425 5th Ave. N, 1st Floor		Nashville	TN	37247
Lucas	Mark	Anderson Co. Sheriff's Office	101 S. Main St	Suite 400	Clinton	TN	37716
Martin	Sonny	Knox County Sheriff	400 Main Street		Knoxville	TN	37902
McFadden	Jack	F&A Office for Info. Resources	312 8th Ave N	17th Floor	Nashville	TN	37243
Miller	Jeff	Motorola	341 Cool Springs Blvd.	Suite 300	Franklin	TN	37067
Mitchell	Ken	KY Governor's Office for Technology	101 Cold Harbor Drive		Frankfort	KY	40601
Moore	Joel R.	TN Dept of Safety / CVE	1148 Foster Ave		Nashville	TN	37210
Moyers	John	TEMA	P.O. Box 5884		Knoxville	TN	37918
Neathery	Rick	Nashville Metro Govt Radio Shop	41 Peaybody St		Nashville	TN	37210
Patterson	Edgar	Montgomery Co. S.O. TSA	120 Commerce St.		Clarksville	TN	37040
Perigo	Jeff	Greer Communications	910-C Max Ct.		Clarksville	TN	37043
Phipps	Charlie	TWRA	P.O. Box 40747		Nashville	TN	37204
Riggs	Charles	Rhea Co. 911	P.O. Box 85		Evensville	TN	37332
Rittenburg	Gary	DataRadio	6160 Peachtree Dunwoody Rd	Bldg C	Atlanta	GA	30062
Smith	John	Montgomery Co. S.O.	120 Commerce St.		Clarksville	TN	37040
Smith	Rick	THP/Homeland Security	312 Eighth Ave N	TN Towers 25th Fl.	Nashville	TN	37243
Taylor	Casey	AEDC Air Force	Arnold Air Force Base		Arnold Air Force	TN	37389
Terry	Bill	Murfreesboro PD	302 S. Church St		Murfreesboro	TN	37130
Tarrance	Frank	Memphis Police Dept	79 South Flicker St		Memphis	TN	38104
Updegraff	Bob	Wireless Solutions	720 Fesslers Lane		Nashville	TN	37210
Williams	Kevin	TBI	901 R.S. Gass Bldg		Nashville	TN	37216

11. Conclusion

It is the hope of the Region 39 4.9 GHz working group and the Region 39 700 MHz RPC that this document will serve as a Guideline for public safety entities wanting to implement this spectrum. The FCC has given the maximum flexibility possible to develop systems that support not only a single agency, but multiple agency across jurisdictional and discipline boundaries to work together for the good of both public safety and the public.

Region 39 will continue to promote, educate and assist as needed in the development of the 4.9 GHz spectrum for public safety in Tennessee.

John W. Johnson
Chairman
Region 39 700 MHz Regional Planning Committee

May 12, 2005